

## PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup>

### TRIAL BATCH SUMMARY

Project: \_\_\_\_\_ Date: \_\_\_\_\_  
 Contractor: \_\_\_\_\_ Concrete for: \_\_\_\_\_  
 Concrete producer: \_\_\_\_\_ Class of concrete: \_\_\_\_\_  
 \_\_\_\_\_ Mix designation: \_\_\_\_\_

#### • COMPRESSIVE STRENGTH (28 DAY)

Minimum average strength required<sup>2</sup> ( $f_{cr}$ ) \_\_\_\_\_ megapascals (MPa)  
 Design strength specified ( $f'_c$ ) \_\_\_\_\_ MPa

#### • PROPORTIONS

Material	Specific Gravity (SSD)	SSD Mass per m <sup>3</sup> (kg)	Absolute Volume (m <sup>3</sup> )	Tolerance % ( $\pm$ )	Admixtures	Dosage per m <sup>3</sup> (mL)
Cement	3.15	_____	_____	1	Air entrainment	_____
Water	1.00	_____	_____	1	Water reducer	_____
Coarse aggregate	_____	_____	_____	2	Retarder	_____
Fine aggregate	_____	_____	_____	2	Color	_____
Total air	_____	_____	_____		Accelerator	_____
Other _____	_____	_____	_____		Other _____	_____
Totals		_____ kg	_____ m <sup>3</sup>			

#### • PROPERTIES

Water/cement ratio (by mass) \_\_\_\_\_ Theoretical unit mass \_\_\_\_\_ kg/m<sup>3</sup>  
 Measured unit mass \_\_\_\_\_ kg/m<sup>3</sup> Measured air content \_\_\_\_\_ percent  
 Measured slump \_\_\_\_\_ mm

#### • MEASURED COMPRESSIVE STRENGTH

Individual 7-day, MPa \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ . Average (7 day): \_\_\_\_\_ MPa  
 Individual 28-day, MPa \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_ . Average (28 day): \_\_\_\_\_ MPa

<sup>1</sup> For normal mass portland cement concrete (2300 - 2500 kg/m<sup>3</sup>).

<sup>2</sup> See page 5.

<sup>3</sup> Bulk SSD.

The water/cement ratio for modified concrete is the ratio of the mass of water to the combined masses of portland cement and cement substitute.

• **SIGNATURES** Contractor: \_\_\_\_\_  
 Mix Designer: \_\_\_\_\_

**PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup>** (Continued)  
**MATERIALS SOURCE SUMMARY**

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• **CEMENT (AASHTO M 85)**

Name and address of cement producer: \_\_\_\_\_

Source of manufacture: \_\_\_\_\_

\_\_\_\_\_

Type of cement: \_\_\_\_\_ Materials certification attached: ☐ Yes ☐ No

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• **WATER (725.01 and AASHTO T 26)**

Water potable: ☐ Yes ☐ No      If no, provide the following:

Water pH number \_\_\_\_\_  
Chloride concentration \_\_\_\_\_ (ppm)  
Sulphate ion concentration \_\_\_\_\_ (ppm)  
Total solids content \_\_\_\_\_ (%)

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• **ADMIXTURES**

Material	Producer and Product Designation	Certification Attached	
		Yes	No
Air entraining admixture	_____	<input type="checkbox"/>	<input type="checkbox"/>
Water reducing admixture, type A	_____	<input type="checkbox"/>	<input type="checkbox"/>
Retarding admixture, type B	_____	<input type="checkbox"/>	<input type="checkbox"/>
Accelerating admixture, type C	_____	<input type="checkbox"/>	<input type="checkbox"/>
Water reducing and retarding admixture, type D	_____	<input type="checkbox"/>	<input type="checkbox"/>
Water reducing and accelerating admixture, type E	_____	<input type="checkbox"/>	<input type="checkbox"/>
Water reducing, high range admixture, type F	_____	<input type="checkbox"/>	<input type="checkbox"/>
Fly ash, type _____	_____	<input type="checkbox"/>	<input type="checkbox"/>
Ground iron blast-furnace slag	_____	<input type="checkbox"/>	<input type="checkbox"/>
Silica fume (microsilica)	_____	<input type="checkbox"/>	<input type="checkbox"/>
Color additive	_____	<input type="checkbox"/>	<input type="checkbox"/>
Other: _____	_____	<input type="checkbox"/>	<input type="checkbox"/>

<sup>1</sup>For normal mass portland cement concrete (2300 - 2500 kg/m<sup>3</sup> ).

# PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup> (Continued)

## MATERIALS SOURCE SUMMARY

### • COARSE AGGREGATE (703.02 AND AASHTO M 80)

Name of supplier/producer: \_\_\_\_\_

Location of material source: \_\_\_\_\_

Material type: ☐ Gravel ☐ Crushed gravel ☐ Crushed stone ☐ Crushed blast furnace slag

Grading no.: \_\_\_\_\_

#### Sieve Analysis:

Sieve Designation	Percent Passing	Specification
50 mm	_____	_____
37.5 mm	_____	_____
25.0 mm	_____	_____
19.0 mm	_____	_____
12.5 mm	_____	_____
9.5 mm	_____	_____
4.75 mm	_____	_____
2.36 mm	_____	_____
1.18 mm	_____	_____

#### Properties:

- (1) Coal and lignite \_\_\_\_\_ (%) (0-0.5)<sup>3</sup>
- (2) Deleterious chert \_\_\_\_\_ (%) (0-3)<sup>3</sup>
- (3) Sodium sulfate soundness<sup>2</sup> \_\_\_\_\_ (%) (0-12)<sup>3</sup>
- (4) Clay lumps and friable particles \_\_\_\_\_ (%) (0-2)<sup>3</sup>
- (5) LA abrasion \_\_\_\_\_, grading \_\_\_\_\_, \_\_\_\_\_ % loss (0-40)<sup>3</sup>
- (6) Bulk specific gravity \_\_\_\_\_
- (7) Absorption \_\_\_\_\_ (%)
- (8) Bulk SSD specific gravity \_\_\_\_\_
- (9) Dry rodded unit mass \_\_\_\_\_ (kg/m<sup>3</sup>)
- (10) Minus 75  $\mu$ m \_\_\_\_\_ (%) (0-1)<sup>3</sup>
- (11) Adherent fines \_\_\_\_\_ (%) (0-1)<sup>3</sup>
- (12) Other \_\_\_\_\_

### • FINE AGGREGATE (703.01 AND AASHTO M 6)

Name of supplier/producer: \_\_\_\_\_

Location of material source: \_\_\_\_\_

☐ Manufactured sand ☐ Natural sand ☐ Blend

#### Sieve Analysis:

Sieve Designation	Percent Passing	Accumulative Percent Retained
9.5 mm	_____	_____
4.75 mm	_____	_____
2.36 mm	_____	_____
1.18 mm	_____	_____
600 $\mu$ m	_____	_____
300 $\mu$ m	_____	_____
150 $\mu$ m	_____	_____

Fineness modulus: \_\_\_\_\_

#### Properties:

- (1) Clay lumps \_\_\_\_\_ (%) (0-3)<sup>3</sup>
- (2) Coal and lignite \_\_\_\_\_ (%) (0-1)<sup>3</sup>
- (3) Sodium sulfate soundness<sup>2</sup> \_\_\_\_\_ (%) (0-10)<sup>3</sup>
- (4) Sand equivalent value, alt. 2 \_\_\_\_\_ (>75)<sup>3</sup>
- (5) Bulk specific gravity \_\_\_\_\_
- (6) Bulk SSD specific gravity \_\_\_\_\_
- (7) Absorption \_\_\_\_\_ (%)
- (8) Organic impurities \_\_\_\_\_
- (9) Minus 75  $\mu$ m \_\_\_\_\_ (%) (0-3)<sup>3</sup>
- (10) Other \_\_\_\_\_

<sup>1</sup> For normal mass portland cement concrete (2300 - 2500 kg/m<sup>3</sup>).

<sup>2</sup> At five cycles.

<sup>3</sup> Specification limits.

**PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup>** (Continued)  
**DATA FOR COMPUTING THE COEFFICIENT OF VARIATION OF BATCHES**

Batch No.	Date Batched	7-Day Compressive Strengths (MPa)				28-Day Compressive Strengths (MPa)			
		Cyl. 1	Cyl. 2	Cyl. 3	Average ( $\bar{x}$ )	Cyl. 1	Cyl. 2	Cyl. 3	Average ( $\bar{x}$ )
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									

<sup>1</sup> For normal mass portland cement concrete (2300 - 2500 kg/m<sup>3</sup> ).

$$\bar{X} = \frac{\sum X}{N} = \frac{\sum \bar{x}}{N} = \text{_____ (MPa)} \quad s = \sqrt{\frac{N \sum (X^2) - (\sum X)^2}{N(N-1)}} = \text{_____}$$

Where:

- $\bar{X}$  = The 28-day batch average of at least 2 cylinders (3 preferred).
- $\bar{x}$  = The mean of the averages of 28-day compressive results.
- s = The sample standard deviation of the 28-day batch averages.
- N = The number of batches sampled.

**PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup> (Continued)**  
**DETERMINATION OF MINIMUM MIX DESIGN COMPRESSIVE STRENGTH**

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● **MINIMUM MIX DESIGN COMPRESSIVE STRENGTH ( $f_{cr}$ )**

Computed values from page 4:

$$\bar{X} = \underline{\hspace{4cm}} \text{ (MPa)} \quad s = \underline{\hspace{4cm}}$$

Where:

$s$  = The sample standard deviation of the 28-day compressive strength test results from page 4.

$\bar{X}$  = The mean of the 28-day compressive strength test results from page 4.

$V$  = The *coefficient of variation*<sup>2</sup> expressed as a decimal and calculated as follows:

$$V = \frac{s}{\bar{X}} = \underline{\hspace{4cm}} = \underline{\hspace{4cm}} \text{ or } 0.15$$

$$f_{cr} = \frac{f'_c}{1 - kV} = \frac{f'_c}{1 - 1.28 ( \quad )} = \underline{\hspace{4cm}} \text{ (Mpa)}$$

Where:

$f'_c$  = The 28-day design compressive strength specified in the contract.

$k$  = A constant (1.28) for a probability that not more than 1 in 10 tests will fall below the specified compressive strength ( $f'_c$ ).

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<sup>1</sup> For normal mass portland cement concrete (2300 - 2500 kg/m<sup>3</sup>).

<sup>2</sup> Use 0.15 for the coefficient of variation when there is insufficient test data available.

**PORTLAND CEMENT CONCRETE MIX DESIGN<sup>1</sup> (Continued)**  
**LABORATORY TRIAL BATCH MIX DESIGN SUMMARY**

Description	Equivalent Batch Masses (SSD mass/m <sup>3</sup> )				
<b>Materials:</b>	Batch 1	Batch 2	Batch 3	Batch 4	Batch 5
Cement (kg)					
Water (kg)					
Coarse aggregate (kg)					
Fine aggregate (kg)					
Air entrainer (mL)					
Water reducer (mL)					
High range water reducer (mL)					
Other _____					
<b>Properties:</b>					
Water/cement ratio					
Theoretical unit mass (kg/m <sup>3</sup> )					
Measured unit mass (kg/m <sup>3</sup> )					
Measured air content (%)					
Measured slump <sup>2</sup> (mm)					
Ambient temperature (°C)					
Concrete temperature (°C)					
<b>Measured Compressive Strengths (MPa):</b>					
Individual 7-day					
Individual 7-day					
Individual 7-day					
Average (7-day)					
Individual 28-day					
Individual 28-day					
Individual 28-day					
Average (28-day)					

<sup>1</sup> For normal mass portland cement concrete (2300 - 2500 kg/m<sup>3</sup>).

<sup>2</sup> Measure slump values on concrete before and after addition of high range water reducer if used.